REMARKS/ARGUMENTS

Favorable reconsideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 21-34 are pending in the present application. Claims 21 and 28 having been presently amended, Claims 23, 27, 30, and 34 having been canceled by the present amendment without prejudice, and Claims 1-20 having been previously canceled.

In the outstanding Office Action, Claims 21, 22 and 24-26 were rejected under 35 U.S.C. § 103(a) as unpatentable over U.S. Patent No. 6,281,626 to Nakamura et al (herein "Nakamura et al") in view of U.S. Patent No. 5,861,707 to Kumar; Claims 21-23 and 26-27 were rejected under 35 U.S.C. § 103(a) as unpatentable over Nakamura et al in view of U.S. Patent No. 6,441,550 to Patterson et al (herein "Patterson et al"); Claims 28, 29 and 31-33 were rejected under 35 U.S.C. 103(a) as unpatenable over U.S. Patent No. 5,982,095 to Jin et al (herein "Jin et al") in view of U.S. Patent No. 5,861,707 to Kumar; Claims 28-30 and 33-34 were rejected under 35 U.S.C. 103(a) as unpatenable over Jin et al in view of Patterson et al; and Claims 21-34 were rejected under the judicially created doctrine of obviousness-type double patenting over Claims 1-12 in U.S. Pat. No. 6,781,294.

Independent Claims 21 and 28 define an electron emitter having a mixed phase of diamond phase and conductive carbon phase. The diamond phase includes granular bodies doped with at least one element selected from the group consisting of phosphorus, sulfur, and boron, and the conductive carbon phase is formed between the granular bodies and extends in the form of a channel between the supporting member and the electron-emitting surface in the electron emitter.[1]

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[1] Support for the doping elements is found in the specification at page 11, lines 1-3. Support for the configuration of the conductive carbon phase is shown in Applicants' Figures 3 and 4.

The Office Action acknowledges that Nakumura et al is silent regarding the limitation of a mixed phase of a diamond phase and a conductive phase.[2] Furthermore, the Office Action acknowledges that Jin et al is silent regarding the limitation of a mixed phase of a diamond phase and a conductive phase.[3] The outstanding Office Action then asserts that it would be obvious to use the electron emitter disclosed by Kumar in the cold cathode electric discharge lamp of Nakamura et al.[4] The outstanding Office Action also asserts that it would be obvious to use the electron emitter disclosed by Patterson et al in the cold cathode electric discharge lamp of Nakamura et al.[5]

Applicants respectfully traverse this assertion of obviousness for the following reasons.

One of the main mechanisms for electronic discharge in a cold cathode electric discharge lamp such as that of Nakamura et al is secondary electronic discharge. However, secondary electronic discharge of Nakamura et al, which utilizes photoemission stimulated from a glow discharge, differs from the vacuum field emission of Kumar, which utilizes a carbon system field emitter that emits electrons from regions of enhanced electric field into a vacuum.[6] . Since Nakamura et al and Kumar utilize different mechanisms and accordingly utilize different principles of operation, there is no proper motivation to combine these references. For instance, M.P.E.P. § 2143.01 requires that, if the proposed modification or combination of prior art would change the principle of operation of the prior art being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. In the present case, as to be discussed, to realize the advantages of the vacuum

[2] Office Action, page 2, lines 24-26.
[3] Office Action, page 5, lines 15-17.
[4] Office Action, page 3, lines 8-12.
[5] Office Action, page 4, lines 16-20.
[6] Kumar, col. 1, lines 20-31 and 54-65.

field emission of Kumar, one would have to change the operation of the secondary electronic discharge of Nakamura et al such that no discharge existed.

In comparing secondary electronic discharges to field emission, there are various emission mechanisms in secondary electronic discharges that depend on light emissive secondary electronic discharge and electronic irradiation for operation. Such mechanisms are not present in the vacuum field emission of Kumar. Indeed, one particulat mechanism in the electric discharge lamp that is not present in a vacuum field emitter is secondary electronic discharge by irradiation of a rare gas ion. Such a mechanism is described in the specification and is illustrated in Figure 5 of the specification. While a secondary electronic discharge is first established, other field discharge events such as for example emission of thermo-electrons are not denied.[7] Accordingly, as discussed in more detail below, secondary electronic discharge is a prominent factor in a discharge lamp such as the cold cathode electric discharge lamp of Nakamura et al. However, such a factor is not present in the vacuum field emission of Kumar.

The Office Action's assertion of obviousness is apparently based on a misconception that electron emission in a secondary electronic discharge environment and field emission in a vacuum device are based on a common principle. However, given the above-noted discussion and the specification's detailed discussion of the varied mechanisms in a secondary electronic discharge, the mechanism of the secondary electronic discharge is a principle of operation significantly different than vacuum field emission that occurs in vacuum and typically from regions of enhanced electric field concentration, as for example at asperities or protrusions on the surfaces of the cathode element.

For example, in Kumar, the protrusion structure for field concentration plays a prominent role in which field enhancement by geometry of the emitter stimulates electron

[7] Specification, page 8, line 7, to page 9, line 11.

emission into the vacuum.[8] Indeed, Figure 2 of Kumar shows a variety of emission areas 30 protruding from the conductive metal 22. Meanwhile, field enhancement is not a prominent factor in a discharge lamp. For example, Nakamura et al disclose that:

> A cold emission discharge fluorescent tube or plasma display panel which emits visible light upon this glow discharge comprises a vessel having a plurality of electrodes and an inner wall coated with a fluorescent material and a mixture of a rare gas and mercury sealed in the vessel. Electrons emitted in accordance with the ***photoemission phenomenon by light incident*** on the cold emission discharge fluorescent tube initially move by an electric field applied to the electrodes and come into collision with the gas and the like sealed in the vessel, thereby ionizing gas to produce ions. These ***ions collide with the electrodes to generate secondary electrons***. The electrons emitted by the cold emission electrode collide with vaporous mercury atoms to start glow discharge, thereby generating ultraviolet rays. The fluorescent material is excited with the ultraviolet rays to emit visible light.[9] [emphasis added]

Hence, electrons in Nakamura et al are emitted in accordance with the photoemission phenomenon which in turn generate ions that collide with the electrodes to generate secondary electrons. Meanwhile, Kumar utilize a different principle of operation in that electron vacuum field emission in Kumar occurs by field enhancement, with no photoemission or ion-generated secondary emission.

Moreover, Applicants submit that, since the electrodes in Nakamura et al are covered by a conductive electric discharge gas plasma (i.e., the glow discharge) at the time of electric discharge, the field concentration or enhancement effect provided by the proposed projection structures of Kumar asserted in the Office Action would not be expected. Accordingly, one of ordinary skill in the art would not expect any field enhancement effect if the protrusion structures in Kumar were added to the discharge lamp of Nakamura et al. Only if the discharge lamp of Nakamura et al was operated at low pressure (i.e., in a vacuum in which no discharge would exist) would one realize the advantages of the protrusion structures in Kumar. Yet, such a modification would change the basic principle of operation of the

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[8] Kumar, col. 1, line 66, to col. 2, line 19.
[9] Nakumura et al, col. 1, lines 43-57.

discharge lamp of Nakamura et al. Therefore, one of ordinary skill in the art would not be motivated to add the projection structures of Kumar to the discharge lamp of Nakamura et al, as asserted in the Office Action.

Furthermore, as discussed above regarding Figure 2 in Kumar, the compound structure of a fine crystal and a conductive matrix (i.e., the conductive metal 22) in Kumar is utilized in Kumar because it is easy to form a useful acute structure in order that the embedded crystal may obtain field concentration or enhancement. The conductive matrix in Kumar occupies almost all the cathode surface, and the fine crystals (i.e., the vacuum emitters) are disposed to be separated from each other in smaller regions of the cathode surface.

On the other hand in the presently claimed invention (in order to obtain an electronic emitter), a mixed phase of a diamond phase and a conductive carbon phase is used for the cold cathode. This configuration is not obvious in view of any of the cited references. Unlike the structure of Kumar in which separate discrete diamond crystals 14 exist in the conductive metal 22 (see for example Figure 3D of Kumar), as defined in independent Claims 21 and 28 by the mixed phase and as shown illustratively in Figures 3 and 4 of the specification, conductive regions 24 are dispersed among the diamond phases 23. As such, the diamond phase can occupy an area as large as possible on the cold cathode.

Regarding Patterson et al, Patterson et al, like Kumar, show field emission into vacuum. In Patterson et al, a conductive phase is formed in the insulating carbon matrix in the shape of a channel to obtain electron emission by field concentration. Thus, the principle of operation in Patterson et al is the same as that of Kumar in that field concentration is used to stimulate electron emission into the vacuum. It is by the tip of conductive channel-like

structures in Patterson et al that an electron is emitted, and a matrix portion is only an insulated layer for field concentration of the conductive channel phase taught therein.

In the present invention, by utilization of the diamond phase, secondary electronic discharge of electrons (as discussed above) can occur while the channel-like domain (i.e., the conductive carbon phase) can promote transportation of charge within a layer. These effects and principles of operation contrast with Patterson et al in which the channel-like domain provides the source of field emission into a vacuum. Indeed, for this reason, in Patterson et al, the channel-like domain is shown such that channel-like domain is exposed to the flat surface, and is not formed on the retreating surface.

On the other hand, in the present invention, the channel phase (i.e., the conductive carbon phase) can arrive at the surface and does not necessarily arrive at a peak or a valley. Rather, in order to secure conductivity, the channel rate can be the minimum rate, and the structure of the present invention permits the diamond phase to occupy the whole cathode surface, and therefore does not depend on the unevenness of the cathode surface, as would be emphasized in vacuum field emission.

Accordingly, with different principles of operation between Patterson et al's and Kumar's vacuum field emission and Nakamura et al's secondary electronic discharge and with none of the applied prior art teaching a mixed phase of a diamond phase and a conductive phase, it is respectfully submitted that independent Claims 21 and 28 and the claims dependent therefrom are not obvious in view of the presently applied prior art, without impermissible hindsight reconstruction offered only by the Applicants' specification.

Finally Applicants respectfully submit that the present amendment removes the double patenting rejection, as the present independent claims recite the feature of a fluorescent film coated on an inner surface of the envelope, not found in the claims of U.S.

Pat. No. 6,781,294 and therefore not obvious in view of the claims of U.S. Pat. No. 6,781,294.

Consequently, in light of the above discussion and in view of the present amendment, the present application is believed to be in condition for allowance, and an early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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